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Obesity in Pregnancy : Consequences, Management, and Potential Amelioration

The majority of adults in the United States are overweight or obese and the prevalence of obesity has increased dramatically over the past few decades. In one recent report (*Am J ObGynec* 2001; 185:845), the percentage of pregnant women with a body mass index greater than 29 kg / m^2 increased from 16% to 36% from 1980 to 2000. Although in the past various weight cutoffs were used to define obesity, currently the body mass index is usually chosen. It is determined by dividing the weight of a woman in kilograms by her height in meters squared. The advantage of the BMI over using an individual's weight alone is to distinguish the tall woman who is not fat from the short woman who is. Body mass categories for the start of pregnancy are indicated in the table, as are the Institute of Medicine recommendations for weight gain during pregnancy. A BMI greater than 29 defines obesity. This BMI is achieved by a weight more than 147 pounds for a woman 5 feet tall and more than 191 pounds for a woman 5 feet 8 inches tall. Morbid or extreme obesity is often defined as a BMI greater or equal to 40.

Institute of Medicine Recommendations for Weight Gain in Pregnancy (National Academy Press; 1990; Washington D.C.)

Initial Body Mass Index	*IOM Recommended Gestational Weight Gain lb/kg*
<19.8 (low)	28-40 / 12.5-18
19.8-26.0 (normal)	25-35 / 11.5-16
26.1-29.0 (high)	15-25 / 7-11.5
>29.0 (obese)	at least 15 / at least 6

The goal of the Institute of Medicine weight gain recommendations was to minimize the rate of low birth weight infant delivery. It was recognized that infants of low birth weight (less than 2500 g or less than 5-1/2 pounds) were at increased risk for neonatal mortality and morbidity. This public health interest in minimizing the rate of low birth weight infant delivery by liberalizing weight gain recommendations for the pregnant woman may have had unintended adverse consequences, but more about that later.

Are there increased risks of obesity on pregnancy outcome?

There certainly are. Studies which look at the relationship between obesity and pregnancy outcomes are retrospective comparisons. Some are from individual institutions where small numbers preclude identifying an association between obesity and very infrequent occurrences; others are from large databases raising questions as to the validity of the entered data. Nonetheless, the results of most studies are uniform concerning many risks and complications. The relative risks that the obese pregnant woman faces compared with her non-obese counterpart depend on how controlled the studies are for confounding variables (e.g., advanced age, low socioeconomic status). Studies are uniform or nearly so regarding the following complications:

- Diabetes mellitus (mostly gestational, but also insulin dependent).
- Hypertension (both chronic and preeclampsia).
- Labor induction.
- Dystocia in labor.
- Cesarean delivery (and decreased likelihood of VBAC success).
- Fetal macrosomia.
- Shoulder dystocia.
- Wound complications.
- Possible increased risk of fetal neural tube defects (studies vary).
- Possible increased risk of fetal death (overall, the risk is increased, but it is unclear whether this is true, independent of hypertension and diabetes).

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Management

Obesity increases the difficulty of providing obstetric care. It is well recognized that surgery is more difficult in the obese patient, but many other aspects of care are as well. Clinically estimating fetal weight or presentation, institution of anesthesia, obtaining intravenous access, and ultrasound examinations are all much more difficult in the obese woman. In my view in the presence of obesity, routine care should be modified as follows:

1. Dietary advice / weight gain recommendation. Suggest that the patient eat well-balanced meals to appetite. Although the Institute of Medicine recommendation is that the obese woman should gain at least 15 pounds (6 kg) during pregnancy, I don't think she has to gain any weight during the pregnancy. In contrast to the small or average size woman, the relationship between weight gain in pregnancy and birth weight in the obese woman is minimal. In a study done at the University of Iowa, birth weight as the dependent variable was related to several other variables in pregnant women categorized by quartiles of body mass index. Total weight gain during pregnancy was the most important predictor of birth weight for the thinnest quartile and was very important in the middle quartiles. In the most obese women as indicated by BMI, however, although the rate of weight gain in the 3rd trimester was significantly associated with birth weight, total weight gain was not. At least in our population, the abundant caloric reserves and increased blood volume and cardiac output in a very large woman at the onset of pregnancy apparently ensure adequate fetal nourishment. It should also be pointed out that there is only a modest correlation between caloric intake in pregnancy and weight gain. Much of the weight gain in pregnancy is fluid accumulation, which is independent of the calories ingested. Finally, it is likely that there is only modest association between the recommendations that the physician makes regarding weight gain or caloric intake and the weight gain or caloric intake which takes place during pregnancy. Prescribe vitamin and mineral supplements; interdict smoking.
2. Establish a reliable EDD. Many obese women do not ovulate regularly. Pelvic examination to determine uterine size in early pregnancy and fundal heights later in pregnancy are severely hampered by obesity. Therefore, I think an ultrasound examination early in pregnancy should be done in order to date the pregnancy. If diabetes or hypertension later supervene, it is very useful to have precise dating. Followup ultrasound examinations can be done to rule out malformations (diabetes) and intrauterine growth restriction (hypertension). In late pregnancy, an estimated fetal weight by ultrasound may help determine the route of delivery, especially in women with diabetes.
3. Rule out glucose intolerance early in the second trimester, as well as at 26-28 weeks' gestation. If gestational diabetes is diagnosed earlier in the pregnancy, there is more time to have blood sugars under control and to, therefore, minimize perinatal consequences.
4. Utilize a blood pressure cuff of appropriate size. The bladder of the cuff should cover 80% of the arm's circumference in order to provide an accurate reading. Too small a cuff means too high a reading.
5. Employ third trimester fetal well being testing and induction of labor as indicated (diabetes, hypertension, postdatism). Whether the obese gravida in the absence of hypertension or diabetes should have nonstress testing performed in late pregnancy is uncertain.
6. In labor, remember that the protraction disorders in the first stage of labor or a prolonged second stage may indicate a relative mechanical mismatch. Macrosomia increases the risks for maternal and fetal trauma. Be cautious about operative vaginal delivery.
7. If cesarean delivery is required, my personal preference is to open the abdomen through a vertical incision. The inferior limit of the incision should be perpendicular to the top of the pubic symphysis. If a large panniculus is present, most or all of the incision may be above the umbilicus. Mechanical means of thromboprophylaxis should be considered. Prophylactic antibiotics are given after cord clamping. My preference for closure of the abdominal wall is to utilize a continuous mass closure technique. The literature is divided as to the value of suturing the subcutaneous tissues and the use of subcutaneous drains. My personal preference is to close the fat and not utilize a drain.

Weight gain recommendations in pregnancy and the prevention of obesity

Forty years ago in the United States, the obstetric recommendation for weight gain in pregnancy was to limit total weight gain to 25 pounds and ideally to 20 pounds. Although it was not rational, the thought was that preeclampsia might be prevented. While it is true that fluid retention in a woman with preeclampsia results in a

large weight gain, there is no evidence that calorie restriction prevents preeclampsia. Nonetheless, the obstetric focus was to attempt to seriously limit weight gain during pregnancy. The recognition of the risks of low birth weight and of an association between low maternal weight gain and increased rates of low birth weight infant delivery gave rise to the Institute of Medicine recommendations listed above. I think an unintended consequence of this is that obstetric providers began paying too little attention to excessive weight gain during pregnancy. I know this has been a deficiency in the prenatal care, which I provide. In one recent study, nearly half of the women gained more than the Institute of Medicine recommendations. In the entire United States population in 2002, 19% of parturients gained more than 40 pounds during pregnancy.

Although the relationship between caloric intake in pregnancy and weight gain is only modest and although the relationship between the advice that we give and what a patient does is also only modest, I think it is time for us to reemphasize the importance of not gaining excessive weight during pregnancy. At the time of the first prenatal visit, the body mass index should be calculated and depending on the weight gain category of a patient, a recommended weight gain for the pregnancy should be provided. As stated above, I do not think the obese woman needs to gain any weight during her pregnancy. For the woman in the high initial body mass index category, I think a weight gain of 15 to 20 pounds is appropriate. As pregnancy progresses, we should pay attention to how much weight a woman is gaining and should reemphasize the importance of these weight gain limits. It is certainly typical for a woman not to lose all the weight she gains during her first pregnancy and then to repeat this event on another couple of occasions and to wind up at age 30 being 30 or 40 pounds overweight. We might during obstetric care be able to positively affect this phenomenon.

Given the current obesity epidemic, a public health strategy focused on preventing excessive weight gain in pregnancy may be more beneficial overall than one attempting to prevent inadequate weight gain. Pendulums do swing.

—Frank J. Zlatnik, M.D.

Questions and Answers Regarding Progestins and Preterm Birth Prevention

Q: What's the buzz?

A: Progesterone, produced by the corpus luteum and later by the placenta, has been considered important in the maintenance of pregnancy. Progesterone suppresses the synthesis of certain proteins associated with uterine contractions and stimulates the production of an enzyme which breaks down prostaglandins. In some mammals progesterone levels fall prior to labor.

In the human, however, plasma progesterone levels don't fall prior to labor and levels are not lower in women who deliver preterm compared with those who deliver at term. In addition, progesterone has not been demonstrated to be an effective tocolytic and is ineffective in the treatment of threatened abortion. Nonetheless, a study 30 years ago suggested that progesterone might be effective in preventing preterm delivery in women with histories of previous preterm births.

The recent "buzz" is due to the results of two double-blind, placebo-controlled randomized trials of progestin administration. In one trial (*New England Journal of Medicine* 348:2379, 2003) 17-α-hydroxyprogesterone caproate was compared to placebo in more than 400 women with histories of previous preterm deliveries. Two hundred and fifty milligrams of the drug by intramuscular injection was given weekly starting at 16-20 weeks' gestation and continuing until 36 weeks' gestation. Statistically significantly fewer women delivered preterm (less than 37 weeks) in the progesterone group as compared to the placebo group. In addition, there were statistically significantly fewer early preterm deliveries. Eleven percent of those in the active drug group delivered under 32 weeks compared with 20% in the placebo group.

A second study utilizing progesterone vaginal suppositories (*American Journal of Obstetrics and Gynecology* 188:419, 2003) in women at high risk for preterm delivery also gave encouraging results. Progesterone vaginal suppositories (100 mg nightly) were prescribed from 24 to 34 weeks' gestation. Twenty-nine percent of the women receiving the placebo suppositories delivered preterm compared with 14% of those receiving progesterone. Nineteen percent of placebo recipients delivered earlier than 34 weeks' gestation compared with 3% of those receiving progesterone.

Q: Who are candidates for progestin treatment?

A: The two studies cited above involved women with histories of previous preterm births. The drugs were effective in preventing preterm birth in a subsequent pregnancy. Our own practice is to utilize prophylactic progestin therapy in a woman with a previous delivery under 35 weeks' gestation. This delivery should

have been the result of spontaneous labor or ruptured membranes and not have been a birth induced for medical or obstetric complications in the absence of labor (e.g., preeclampsia).

It is estimated that approximately 20% of early preterm births in Iowa are accounted for by women who have previously delivered preterm. The potential exists, therefore, for progestin therapy to have a measurable impact on the overall rate of preterm delivery.

Q: What drugs should be given?

A: The preparations utilized were either 17-α-hydroxyprogesterone caproate, 250 mg, given IM weekly or progesterone vaginal suppositories, 100 mg, given nightly. Neither of these specific preparations is available from a national pharmaceutical company to the best of my knowledge. We utilize the progesterone vaginal suppositories compounded locally. Practitioners should contact compounding pharmacies in their area in order to see what is available.

Q: When should the drugs be administered?

A: In the one trial, the drug was started between 16 and 20 weeks' gestation and continued until 36 weeks. In the second trial, the drug was administered from 24 to 34 weeks' gestation. In our practice, we begin suppository treatment just prior to mid-gestation (16-18 weeks) and continue it until 34-36 weeks' gestation.

Q: Are there risks associated with progestin treatment?

A: Unlikely. Progesterone is a natural substance normally found at high levels in pregnancy. Theoretically, there could be risks associated with the vehicle in which it is administered. Perhaps pregnancies will be abnormally prolonged. Vigilance is appropriate, but I would not withhold treatment, because of a lack of absolute certainty regarding safety.

Q: What about using progestins in other women at high risk for preterm delivery?

A: Other women at increased risk for preterm delivery, such as those with multiple gestations, positive fetal fibronectin test results, short cervices on ultrasound, previous episodes of threatened preterm labor, etc., might well benefit from progestin administration, but no evidence is yet available supporting its use for these other indications. Trials are undoubtedly underway. If we are to practice evidence-based medicine, I think at this point we should limit progestin use to that category of patients in whom efficacy has been demonstrated, namely women with histories of previous preterm deliveries. It is likely that information will soon be available regarding these other possible indications.

— Frank J. Zlatnik, M.D.

Iowa Begins Newborn Screening for Cystic Fibrosis

A pilot study for the addition of cystic fibrosis (CF) to the newborn screening panel in Iowa was recently approved by the Iowa Department of Public Health. Actual testing began in July 2005, and the pilot phase will continue for one year. Using blood from the same card now collected for the other components of newborn screening, immunoreactive trypsinogen will be assayed, and the top 5% of levels will be subjected to DNA analysis, examining for the 25 most common genetic mutations for cystic fibrosis. During the pilot phase results will be reported to the CF Newborn Screening Coordinator, who will contact individual practitioners with abnormal results and recommended follow up plans.

While newborn screening should identify 99% of infants with CF, an occasional child will continue to be diagnosed only when clinical manifestations suggestive of CF develop.

Further information about the pilot for CF newborn screening is available on the IDPH web site: www.idph.state.ia.us/genetics/pilot_studies.asp.

Questions may also be addressed to Miles Weinberger, MD, UIHC CF Center Director (miles-weinberger@uiowa.edu) or to Beth Dowd, ARNP, Iowa CF Newborn Screening Coordinator (elizabeth-dowd@uiowa.edu) 319-356-1828.

EDITOR'S NOTE: CF carrier screening during pregnancy was considered in The Iowa Perinatal Letter *in 2002 (vol. XXIII, no. 4). CF carrier screening should be offered to Caucasians and Ashkenazi Jewish couples. Hispanics, African-Americans, and Asians should be made aware of the screening options. This differential recommendation, based on ethnicity, reflects differences in the carrier risk state before testing and the carrier risk state after a negative test.*

If both the father and the mother test positive for the CF carrier state, diagnostic testing done at amniocentesis can establish whether or not the fetus is affected with cystic fibrosis. Apart from termination of pregnancy, this information might help a family make adjustments for the birth of a child with a chronic illness. In addition, in the earlier Iowa Perinatal Letter *article, the point was made that numerous studies indicate a nutritional benefit if an early diagnosis of CF is made. Since this should take place as a result of the newborn screening program, some of the advantage of prenatal CF carrier screening is lost for those couples who would not consider termination of pregnancy, given an affected fetus.*

— Frank J. Zlatnik, M.D.

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